

# Evaluation of the Simula Research Laboratory

Report of the Evaluation Committee  
Investigation

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## **To the Research Council of Norway**

The members of the Evaluation Committee reviewing the Simula Research Laboratory submit the following report. The views presented in this report are the unanimous opinion of the members of the Evaluation Committee, and the members of the Evaluation Committee are fully in accord with regard to the assessments, recommendations and conclusions stated in the report.

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# 1. Executive summary and recommendations

The Evaluation Committee is impressed with the progress and level of activity achieved at the Simula Research Laboratory in the comparatively short time since its foundation. The organization has succeeded in generating a vibrant research culture and is now operating as a highly effective research unit with growing international recognition. We commend the self-evaluation document produced as a thorough and accurate assessment of the current state of the laboratory, with a nice balance of awareness of strengths and weaknesses.

The Simula Research Laboratory offers a unique environment that emphasizes and promotes basic research while still covering the broader landscape from postgraduate teaching to commercialization. The organizational and funding framework allows basic research to take centre stage, without any domination by constraints from pursuit of external funding typically found in industrial research institutes, or from the heavier teaching commitments found in the Universities. This emphasis gives the laboratory the opportunity to be highly productive in its chosen areas, but clearly the resources available can only cover a limited number of such areas, and the strategic choice of these areas is of vital importance.

The Evaluation Committee fully supports the current strategy of increasing visibility by promoting the publication of results in high quality journals. Indeed, we believe that this is the only realistic performance measure to apply in a group that is still establishing itself on the international stage. However, we are aware that the laboratory has considered a broader range of uptake measures for the future, including uptake of artefacts such as open source software or transfer to commercial activity via the Simula Innovation subsidiary. The Evaluation Committee **recommends** that the Simula Research Laboratory continues to increase the visibility of this broader range of measures.

Building up a research group of international standing takes time. It is not unreasonable for there to be a period of five years or more from the inception of a new research activity to the appearance of significant results in respected archive quality journals. We believe, therefore, that, since the main research areas are progressing well, it would be premature to propose major changes in direction.

However, the Evaluation Committee does feel that the Simula Research Laboratory's strategy is somewhat conservative. It is appropriate to continue with the current directions at present, but we would have liked to have seen more discussion of the likely evolution of the target areas on a five year timescale and beyond. Some of the departments are more farsighted than others. The Software Engineering Department has a vision of its activity as a grand challenge, which we applaud; the Scientific Computing Department has concentrated on the medium term, and the Networks and Distributed Systems Department is currently primarily concerned with tactical issues. The Evaluation Committee **recommends** that the Simula Research Laboratory revisit its strategy, extending its horizon beyond the five-year point and concentrating on likely changes of focus. It is important that this process should take a strategic view for the laboratory as a whole, should consider renewal of the research base, and should not be bound unduly by the current departmental structure. Formulating the strategy in terms of Grand Challenges is an effective way of articulating the longer-term view.

We have some concerns about the current balance of resources between senior staff and postgraduate students. We regard the total number of PhD students per staff member as low by the standards of world-class academic laboratories, and are particularly concerned by this

when considering that postgraduate education was one of the main stated objectives in establishing Simula. We believe that the number of PhD students should be at least doubled over the next contractual period, although we appreciate that candidates must be selected with care and so do not expect an immediate step change. It may be necessary to look outside Scandinavia for these additional students. The Evaluation Committee **recommends** that Simula raises its postgraduate student targets and that it seek additional resources from the Research Council or elsewhere to make this possible.

The Evaluation Committee believes that Simula has been well served by its Scientific Advisory Board. The laboratory has received good advice and the interactions between Simula and the Scientific Advisory Board seem to have been positive and have established clear goals. We hope that the laboratory will continue to be guided by this board, that its level of involvement will be maintained, and think that its membership should evolve to reflect the changing activities of the laboratory in future.

We feel, however, that the constitution of the Board of Directors could be improved. At present it is dominated by institutional interests, and, with the notable exception of the Chairman, has little industry involvement. We believe that the Board would be strengthened by further industry participation, particularly from those Norwegian knowledge-based industries likely to be able to identify challenges and exploitation areas. The Evaluation Committee **recommends** that the Board of Directors should be reconstituted to include at least two further members with industry backgrounds, even if this means reduction in the academic representation to achieve a workable size. Alternatives could be considered, such as an additional Industrial Advisory Board, but, given the small size of Simula, it is not clear that such an additional structure would be justified.

The Evaluation Committee has been impressed by the quality and coherence of the planning involved in the launch of Simula Innovation, and of the enthusiasm it has generated. We believe that the remit of this unit is important in achieving National benefits from the activities at Simula, and we look forward to seeing its activities develop. We hope that its target of extending the core contractual funding to up to 30% of the total can be achieved, and feel that this target is appropriate, in that it will promote relevance without diluting the special nature of Simula as a basic research laboratory.

The Evaluation Committee has noted that the initiative to create the Simula Research Laboratory formed part of a broader vision for the Fornebu site. This vision foresaw substantial investment in new knowledge-based industry centred on the site and a key role for laboratory in interacting with that industrial base. However, with the notable exception of Telenor, this development has not happened. The result of this is that, whilst the laboratory has established a stimulating working environment in a distinctive building, it is currently disadvantaged by its location, which places an unnecessary barrier to collaboration with the business Centres of North and East Oslo and limits the involvement of graduate students from the University.

The Evaluation Committee is aware that discussions that might lead to a revitalization of the Fornebu initiative are in progress, and that Simula are well placed to play a major role should this happen, but we believe that the Simula Research Laboratory would benefit from relocation if the current initiatives are unsuccessful. The Evaluation Committee therefore **recommends** that the position should be reviewed after the situation has become clear, and certainly within a period of twelve months, with a view to supporting the relocation of the

laboratory if the Fornebu Science Park will not be revitalized; the move should probably be to space adjacent to the University.

Finally, the Evaluation Committee has noted the concerns expressed in the self-evaluation document that the end-date of the current contract will generate uncertainty and depress morale as the second five-year period progresses. We are well aware of the importance of maintaining morale and avoiding distraction from the research goals and so we agree that this is a real threat. It would have a severe impact on the organization if key personnel were to be lost as the end of contract approaches. The Evaluation Committee **recommends** that the Simula Research Laboratory be funded for the next 5 years. Furthermore, to ensure long-term continuity, the Evaluation Committee **recommends** that the Simula Research Laboratory be placed on a rolling 5+5 year contractual basis. An evaluation should be performed at the mid-point of this contract, examining performance and plans for a further ten years. If the evaluation is sufficiently positive, the contract should be extended, so that the laboratory never has less than a five-year planning horizon.

## **2. Simula Research Laboratory evaluation**

### **2.1 Research assessment**

#### **2.1.1 Level of research**

The Simula Research Laboratory has achieved a high level and quality of research output. One of the groups from which it was formed had previously been rated as excellent, and the others as good. We confirm that the best department is still excellent, and that the others are improving. We rate the Scientific Computing Department as excellent. The Software Engineering group is very good, and if it can maintain its current level and quality of output will soon also be internationally acknowledged as excellent. The Networks and Distributed Group is good, with some very good elements, and has the potential to reach higher levels if it can increase the visibility of its work so far.

Over all, the upward trend is very encouraging and bodes well for the future. The publication rates in all departments have increased significantly in 2004. This both reflects the increasing level of maturity of their work and also perhaps indicates an awareness of the evaluation process.

#### **2.1.2 Importance of research fields**

The process by which the original groups were chosen to form the Simula Research Laboratory was one of selection from the best available groups in Norwegian Universities. The fields in which the departments operate are, individually, important, but there are many areas that are not represented. The departments are quite small; they do not claim to cover all aspects of their respective fields, but are striving for excellence in specific topic areas. Thus they are operating in important fields but could make no claim to cover all the important aspects of their areas.

### **2.1.3 National and international scientific collaboration**

The evidence from the external collaborations is that the laboratory is thriving; both in terms of the number of links and the quality of the external organizations involved, there is clear evidence that Simula is operating as an equal with many of the best institutions in the field. The portfolio of letters of support gives impressive support for this view.

### **2.1.4 Contribution to education at MSc and PhD levels**

Making a significant contribution towards postgraduate education is one of the three main objectives of the Simula Research Laboratory; it takes time to build up student numbers, and the record of recruitment and graduation so far is healthy. The Evaluation Committee feels, however, that the total numbers of PhD and MSc students have not yet reached the level that should be expected of an active research laboratory in a science or engineering discipline. We would expect most staff members who are entitled to supervise students to have at least two or three PhD students and an involvement in a larger number of MSc projects. We hope that these targets can be met by all departments within the next few years.

This increase in student numbers may imply a need for additional resources; whilst the Simula Research Laboratory should strive to attract industry funding for graduate students, it must look to the Research Council for at least some of the necessary support. We hope that the Research Council will be able to respond to this, because the kind of high quality environment provided by Simula is one way to make graduate education attractive to potential students, and so help to encourage uptake of postgraduate places in these key skills areas.

### **2.1.5 Attractiveness**

The range of visitors to Simula give clear evidence that the academic environment is attractive, although we were given anecdotal evidence that the geographical location may not be ideal from this point of view. However, visitors do not seem to have been deterred, and we believe that the amount of joint work reported makes it clear that Simula is regarded internationally as a productive research partner.

### **2.1.6 Relevance to Norwegian industry and society**

We believe that Simula can benefit Norwegian industry in a number of ways. By producing a stream of high-grade PhDs, it can help to increase the quality and level of skills of the workforce; by engaging in industrial collaborations it can help solve problems and introduce new ideas into the industry and so increase competitiveness. We have noted that there is now no large native systems vendor in Norway, so the most productive interactions are likely to focus on software or on specialist sub-systems. This includes strengthening of the Norwegian software industry and the support of major primary industries by improving the quality of the software they use. We also see relevant benefit in the potential for start-ups, in both the product and the services areas.

The benefits to society will come, we believe, primarily via the contribution to industry. Strengthening the industry will provide secure employment and additional resources capable of contributing to quality of life in a broader sense.



### **2.1.7 Business establishment**

The plans for exploitation of business opportunities are closely coupled to the development of Simula Innovation, which we address in section 3.4. We are impressed with these plans and believe that they provide a sound framework for the establishment of new businesses.

### **2.1.8 Research plan and strategy**

The Evaluation Committee believes that the research strategy should be more adventurous and should cover a longer planning window. The current strategy concentrates on consolidation and completion of the original vision of the three departments. This is quite understandable, since the Simula Research Laboratory is still completing its initial steps, and so the direct consequences of them loom large in the management's thoughts. However, we believe that the laboratory needs to think in terms of a changing portfolio of projects and interests, and it is not too soon to start addressing the intellectual renewal process. We must make it clear that this does not imply any sudden change of direction; a good start has been made, and it would be counter-productive to attempt short-term retargeting. However, it is clear that, in five years time, some of the current focus areas will have been well explored and that plans need to be made now for how the next generation of initiative is to be nurtured.

The Evaluation Committee believes, therefore, that it would be timely to consider both the process for, and direction of, longer-term renewal, and that this needs to be addressed from both departmental and complete laboratory perspectives.

## **2.2 Management assessment**

### **2.2.1 Recruitment**

One issue that concerns the reviewers is that there is no clear mechanism for renewal and academic regeneration of Simula as a whole. While this is clearly not an issue at present as the academic leaders are all very research active, it may become one in the future as the present staff age gracefully together. One solution to this may be for Simula and the University of Oslo to consider options for involvement with varying time percentages split between the organisations. This would allow both organisations to take into account the varying needs, career paths and aspirations of all concerned.

### **2.2.2 Department organisation and scientific leadership**

One general issue that arises across all the departments is that the senior academic figures have little or no management training; while this is perhaps not such an issue in an academic environment such as a University, Simula is functioning in a way that is closer to a research business model and so should think about ensuring that its leaders have access to as much management and leadership training as they think is useful. For example, the response across the whole of the organisation to the assessment and feedback process has not been good; this should be easy to remedy.

### **3. Research Departments evaluation**

#### **3.1 Networks and Distributed Systems Department**

The Networks and Distributed Systems Department is organized into three projects, ICON, VINE, and QuA. The ICON project is concerned with fault-tolerant interconnection networks, supporting, for example, Storage Area Networks. The VINE project is investigating resilient Internet routing mechanisms. Finally, the QuA project is investigating the design of Quality of Service (QoS) aware component-based middleware for distributed applications.

##### **3.1.1 Assessment of department's scientific contributions**

The ICON project has produced very good research results, including publications, specific interconnect designs, and simulation and verification of the design proposals. The group has gained international recognition, and is well connected to an industrial partner, namely a division of SUN Microsystems located at Oslo. The project members are also involved in the EU project (SIVSS), indicating close cooperation with other European partners.

The VINE project has started only very recently. It is, therefore, too early to judge the scientific quality of the project. However, given the quality and the experience of the researchers involved, we judge that this project will progress productively in the near future. The project addresses resilient Internet routing protocols, which is clearly a very important and relevant area. However, it is not clear that the team has so far identified the key novel approach that is to make their contribution internationally significant.

The QuA project is working on the design of a software architecture for flexible composition and configuration at load or execution time of software components to meet specific QoS requirements of real-time distributed applications, e.g. video streaming etc. After a slow start, the project is now entering a very productive phase, with an increasing number and quality of research publications. The project has produced a software prototype to support their architecture (the QuA platform), which is being made available on an Open Source basis. They are applying this to a range of applications, some of which, such as the on-the-fly video feature extraction, are significant developments in their own right. The group participates, as a coordinator, in a newly formed EU STREP project, MADAM.

We judge that these three projects cover a range of topics in the area of networks and distributed systems. However, it should be noted that this research area is currently very active with many other important subfields that are currently not covered within Simula. These areas range from fundamental topics such as distributed algorithms, or provision of high availability and fault tolerance, to more system-oriented areas such as ad hoc and mobile networks, sensor networks, self-organizing large scale distributed systems including future overlay networks and P2P systems, and large-scale GRID systems.

Given the current level of resources available for the Networks and Distributed Systems Department, we do not believe it is possible to see a major extension of activities, and it will never be possible to cover the full spectrum of networking and distributed systems problems; indeed, it would be desirable to be more selective in the longer term, allowing concentration of resources on perhaps just two key areas.

### **3.1.2 Adequacy between production and financing**

Although the Networks and Distributed Systems Department has a reasonable proportion of the total Simula resources, the conduct of three largely unrelated research projects mean that these resources are thinly stretched. There is a need for either additional external resources or a further integration of activities. One possibility would be to complete the harvesting of the ICON results and to transfer expertise to VINE. Concentration on VINE would also have the advantage of leading to a distinct Norwegian Centre of Excellence in the Internet technologies area. We also believe that this emphasis is most likely to lead to ideas that can be exploited by local industry.

As in many similar groups, shortage of resources has led to an emphasis on simulation; this is not in itself a bad thing, but does make close cooperation with industry of great importance to calibrate simulation with information from practical exemplars. The evaluators noted the positive attitude of the group to the publication of complete details simulation models and test cases to enable reproduction of their results by other groups.

### **3.1.3 International cooperation**

Existing collaborations are quite strong, and we note particularly the industrial collaborations with SUN and Telenor (although cooperation which depends on the divisional placement decisions of a multinational company has the higher risk). QuA is currently weak on industrial collaborations but has good contacts with academic groups, both nationally and internationally; we noted however, that collaboration was not as strong with the University of Oslo as we might expect.

Both ICON and QuA are involved in significant European projects, giving them increased visibility.

The QuA project has identified stronger linkage with Grid activities as a strategic target, but we are not convinced that this is a broad enough view. We would wish to see enhanced linkage of the component work with service composition activities in general. There is also a potential for stronger interaction with SINTEF on the link between component configuration and Model Driven Development.

### **3.1.4 Recruitment**

In general, recruitment has been successful and an effective team has been assembled. However, it would be good to strengthen the general internetworking expertise within the department by recruitment at the postdoctoral level.

### **3.1.5 Balance between categories of employees**

The number of PhDs in this department is higher than the Simula average; however, many other comparable laboratories have more associated students, and so opportunities to increase the number of students to some extent should be sought.

### **3.1.6 Department organisation**

One of the weaknesses of this department is that it is really two groups in one, with two effective leaders; there is not much sharing at intellectual level between the networking and the distributed systems aspects. This makes it difficult to assess the group as a single entity and there is a need to ensure both aspects given equal visibility. It would be better if the evolution of the particular interests could result in better integration, but it is not clear how this can currently be achieved. Management of the laboratory might be simplified by dividing the department into two smaller groups, each with their own focus. This might also lead to a higher assessment of their work, as assessing the department as a whole is bound to lead to comments about lack of cohesion.

### **3.1.7 Scientific leadership**

The quality of scientific leadership is high; the leaders of the individual sub-projects each have a clear vision and a good working relationship with their respective teams. Development of the ideas in VINE is at an early stage, so it is premature to judge these aspects.

### **3.1.8 Research plan and strategy**

The strategic plans presented for this department were not strong. There was undue emphasis on following through existing activities and on being responsive to perceived requirements from Telenor. There was only weak interaction between the networking and distributed systems aspects and there were no common goals between them. We acknowledge that the activities in this department are at different levels of maturity, but would like to have seen them placed within a more coherent programme.

We believe that it is important to have a more specific focus integrating the work of ICON and VINE, and that, after a period of harvesting the current results, emphasis should move towards the rapid development of a coherent programme for VINE.

We favour concentration on VINE because it has a clear exploitation route by collaboration with the telecommunications sector, and this avenue should be pursued.

QuA needs to invest in stronger exploitation links with industry by building up further collaborations. However, in the longer term, there is significant potential for collaboration with the smaller organizations in the software sector, particularly those prepared to offer bespoke platforms or tools directed at the management of component frameworks. Application of the QuA architecture to corresponding aspects of service integration (e.g. in flexible web services) would also be a productive direction.

## **3.2 Scientific Computing Department**

### **3.2.1 Assessment of department's scientific contributions**

The department has a high level of scientific output mostly concentrated in refereed journals and proceedings, but also including software. Both the activities in Software for PDEs and Cardiac Computation are led by distinguished and internationally recognised academics with high levels of publications.

It is worth noting that the research groups represented here were rated as “excellent” in the evaluation of ICT in Norway in 2001. Since then, for example, Professor Langtangen has not only written two single-authored books but has also produced 11 journal papers, 12 book chapters and conference papers and one edited book with Professor Tveito, who also has a similar number of publications. In line with other groups the publication rates have increased significantly in 2004.

During the evaluation period the group has graduated 20 M.Sc. students and 4 Ph.D. students. It is also interesting to note that the research on scripting-based software has had a good educational impact through a popular course at the University of Oslo.

The letters of support are strong and clear in their evaluation of the group’s work as being at a high international level of excellence. The letter from Professor David Keyes is particularly supportive of both the PDE software project and the Cardiac Computation project. The evaluation panel agrees with and endorses this view. One possible qualification is that competing international groups have still closer ties to applications expertise and this may be an issue in the future.

### **3.2.2 International cooperation**

The Scientific Computing group has a good range of collaborations with international groups. This is particularly true of the links with the groups of Professor Peter Hunter in New Zealand and Professor Andrew McCulloch in San Diego. Both these groups are world leaders in cardiac modelling. These collaborations are still in their early stages and of considerable scientific benefit, but have yet to produce significant numbers of publications or joint software. Given the group’s lack of bioengineering expertise it is important that they collaborate with groups such as these to ensure that they have access to domain expertise.

### **3.2.3 Recruitment**

The scientific computing group was recruited as a whole with already good standing and reputations. More recently two new staff have been hired as research scientists possibly to work on the expected new contract with Norsk Hydro.

### **3.2.4 Balance between categories of employees**

The group consists of eight senior researchers, two postdoctoral researchers, six students and a number of part-time researchers and visitors. Although not particularly large, the group has a good balance of employees, sufficient critical mass and good academic leadership.

The Scientific Computing group could expand to have more Ph.D. students. This would increase the educational impact of the group and also broaden its research base. The stated justification for the relatively low number at present is that the group has concentrated on post-doctoral researchers in order to build up a strong software and science base. The forthcoming contract with Norsk Hydro will, if signed, lead to a number of further researchers working in this area.

### **3.2.5 Department organisation and scientific leadership**

The Scientific Computing group has a dual command structure, based on project leaders and principal investigators who are the senior academic figures (Langtangen and Tveito). This is designed to relieve the scientific leaders of the administrative burden associated with the projects and is felt to be a good approach. One issue that has arisen across Simula is that of the level of management feedback through the review process. If this activity wishes to remain an international leader it is important for staff to get constructive and realistic feedback and for the quality of academic leadership to reflect the quality of academic research.

In the area of hardware infrastructure Simula has an adequate supply of high performance computing resources for the initial development of software. In terms of conducting larger scale experiments and proof of concept simulations there is a clear need for access to large scale parallel computing resources. This is an issue because many competing international groups have routine access to local parallel computers with hundreds of processors (and even possibly to thousands of processors remotely situated). We hope that current efforts to reorganise high performance computing in Norway will help in this respect.

### **3.2.6 Research plan and strategy**

The departmental strategy is to continue to focus activity in the two key areas of scientific endeavour. These areas are Cardiac Computations and Software for Partial Differential Equations. This reflects the advice given by the International Evaluation Committee for ICT Research in Norway. These areas are a good fit with the skills of the research groups and have the potential to continue to make a significant impact. For example in the area of Cardiac Computation the group has the possibility to make an impact on healthcare in general and Norway in particular. This will however require the expansion of the already existing medical component of the project to include links to bioengineering and medical researchers. Examples could include helping surgeons to plan operations and with the design of devices to aid the working of the heart.

In the area of software for partial differential equations the applicability and use of the software is a key measure of its success. At present the software being generated by the group is being used on a number of exciting research projects. The overall route for software dissemination is slightly more complex because Diffpack is owned by an external company. The department's desire to distribute open source software is regarded in a very positive way by the review team.

The move towards solving complex multi-physics and multi-scale problems is a positive one and is in line with international trends. At the same time, as indicated in the self-evaluation, it is important to make sure that sufficient modelling expertise is available to ensure that the foundations of the computational work are as sound as can be. It is thus important that the group strengthen and extend existing work with domain-specific mathematical modelling experts in areas such as bioengineering and geophysics.

The proposed new project with Norsk Hydro, seems to be, at the time of review, very close to having its funding confirmed. This is an exciting and very positive step forward. The department and Simula Innovation are to be applauded for moving in this direction. The project as outlined will lead to significant new applications challenges and allow the group to

work on new projects that are both scientifically challenging and helpful to an industry that is important for Norway.

### **3.3 Software Engineering Department**

#### **3.3.1 Assessment of department's scientific contribution**

The Software Engineering Department is involved in a large scale benchmarking activity to evaluate software engineering processes in practice. The department conducts empirical studies of different forms (student or practitioner experiments, case studies etc.) in Norway and abroad to get a better understanding of what is the practice of software engineering and as a means for achieving the goal of supporting software process improvement. In the first phase, the department aimed to provide such support in three ways:

- (a) through guidelines for situated Software Engineering (which technology, process, tool etc. to use in a given Software Engineering project situation);
- (b) by developing theories for cost estimations; and
- (c) by improving OO analysis and design methods.

The Evaluation Committee supports this pioneering benchmarking initiative, which is unique in the world and certainly worth taking to bring out evidence about exactly what the practice of software engineering is today. The impact of such large, realistic and in-depth empirical studies on the software engineering community is potentially of great importance. The Committee was impressed by the empirical findings and considers the scientific contribution of the Software Engineering Department to be at a high level. Given the size of the group and its recent formation, the rate of publications in leading journals and in international conferences in the field is remarkable. The Simula Software Engineering Department is internationally recognised to be one of the experts on empirical software engineering and possibly the only group in which this is a major focus. Letters of support confirm this view. The Committee also acknowledged the fact that the presentation of these studies in Norwegian newspapers and journals contributes to a very positive image for Simula in Norway and is of practical benefit to the software industry. Finally, the Committee appreciated the way the research plan was presented by the department as a 'Grand Challenge'. We recommend, given its level of ambition and its multidisciplinary aspects that the group launch a corresponding project on a larger scale, for instance at the European level.

#### **3.3.2 Adequacy between production and financing**

The group conducted a large number of experiments (54), produced 26 journal papers and 68 conference papers in the first four years of existence; it has given 22 seminars or courses and written 33 articles in newspapers. These are exceptional achievements, particularly when considering the increases in number and quality of the publication. The Committee appreciated the effort made in the presentation to demonstrate the quality of their work by using established yardsticks for the assessment of systems and software engineering scholars and institutions. We recommend that the Simula Research Laboratory continues and, if possible, increases the financial support provided to this department. This is particularly important as the activity has the potential to make a significant impact on the Norwegian software industry and to increase its competitiveness.

### **3.3.3 International cooperation**

The Software Engineering Department has an international visibility particularly in the empirical research community and has established much international cooperation. One of the supporting letters, from Professor Kitchenham, states that the author will ensure that two groups that she is associated with collaborate with this activity. The Committee encourages the department to strengthen international cooperation with a view to achieving the Grand Challenge mentioned above and in particular to increase activity within the EU, possibly through a network of excellence.

### **3.3.4 Recruitment**

The department has grown from six persons in 2001 to 14 persons in 2004. The recruitment was done in a controlled manner with the policy of preferring scientists with industrial experience, which is wise, given the empirical nature of the research. The Committee believes that the policy of employing professionals to undertake the management of experimental projects is a good one. It avoids research leaders being distracted from their main research activity.

### **3.3.5 Balance between categories of employees**

As noted for the other departments, the Committee suggests an increase in the number of PhD students. We are aware of the difficulty of recruiting enough Norwegian students in certain areas and suggest international recruitment with appropriate financial support. This will increase both the breadth and depth of the research of this department.

### **3.3.6 Department organisation**

The department is organised in three research groups and one support group. It is clear that this organisation is flexible, that there exists a good 'esprit de corps' among the members of the department and that work is done according to a shared strategy. The Committee encourages the department to maintain this approach in the future.

The three research groups correspond to the three software engineering areas to which the department wants to contribute by improving the observed software engineering practice. These groups are, as mentioned above, relatively small in size. The advantage of this is that the groups are focussed with little administrative overhead. This may also be a disadvantage, however, in that the groups may be vulnerable if people leave. Given the relatively small size of the research groups it may be important to recruit new academic staff to ensure their continuing critical mass.

Some thought should be given to the structure of this activity, particularly if the work continues to grow in importance. This may involve recruitment and/or forming groups in new areas of software engineering in which the department would like to see research.

### **3.3.7 Scientific leadership**

This department is the smallest of the three groups and also has a high degree of cohesion and interaction. The common values of the senior academics with regard to organizing and conducting research help to provide a stable and supportive environment. The novel nature of



the work and its comparatively recent inception means that there is still work to do in terms of obtaining an academic profile commensurate with the quality of the research. It is important that the group continues to serve on program committees and that it expands its editorial board memberships.

### **3.3.8 Research plan and strategy**

The Evaluation Committee was not completely convinced by the analogy between the Human Genome Project and the proposed Software Engineering Department research plan but it was impressed by the breadth of their vision. We agree that the group should continue to improve their innovative way of conducting empirical studies with continuously greater realism and quality. In particular their involvement with industry and with researchers from a variety of other fields will be of benefit to their research. The move towards more international studies is also important in what is now increasingly a global industry. Finally it is of critical importance that the theoretical work that is proposed should be carried out, as this will provide a solid framework for both present and future work; but it may require further resources in order to be completely successful.

## **3.4 Simula Innovation evaluation**

Creation of a suitable innovation environment is a primary goal of the initiative that created the Simula Research Laboratory; we believe that the creation of a separate organization to enable the pursuit of this goal is not just an accounting convenience, but really reflects the laboratory's commitment to innovation and business creation.

The negotiations with Norsk Hydro, which we hope will reach a successful outcome soon, illustrate the strong role that Simula Innovation will be able to play in stimulating research and identifying productive new directions that can benefit Norwegian industry.

We hope that Simula Innovation will help to strengthen the laboratory as a whole, by increasing relevance and identifying new problems that have a clear path to exploitation.

### **3.4.1 Skills in planning exploitation**

The Evaluation Committee found the presentation of the innovation strategy very impressive; in particular, it felt that the creation of the EFFECT model was a major strength. We noted the collaboration with the University of Oslo on innovation support as being a particularly positive step.

We believe that the provision of training on the exploitation process may help to focus scientific ideas, but feel that there is a need to build up awareness over a period of time. The reports that there is an increasingly active innovation culture are encouraging.

### **3.4.2 Financial resources**

Successful innovation depends on the availability of suitable seed funding at the right stages in the process, and the indications that suitable mechanisms for this are being put in place are welcome. The introduction of measures to provide support for innovation by the Research

Council will help, but innovation is a continuing process and so needs a continuous funding stream; this implies exploring a wide range of possible sources of funding.

We would wish however, to make it clear that we have been asked to perform this evaluation as technical experts; we are not business analysts and cannot speak authoritatively on this topic.

### **3.4.3 Marketing knowledge**

The Simula Innovation staff showed a broad background and awareness of the Norwegian situation; however, it may be harder to track the full range of international opportunities, and there should be a willingness to use external experts where there are gaps in the available expertise.

### **3.4.4 Contact with investors**

Again, this area is peripheral to our competence as a group. The analysis and contact list presented sounded promising, but there is insufficient hard evidence for us to be confident.

However, we noted the link with the University as a potential strength and the claim of links with all major venture capital organizations and some other major investors as a potential strength if it is well founded.

## **4. Evaluation Committee Membership**

Professor Martin Berzins	University of Utah, USA
Professor Bertil Gustafsson	Uppsala University, Sweden
Professor Seif Haridi	Swedish Institute of Computer Science
Professor Peter F. Linington	University of Kent, UK
Professor Colette Rolland	University of Paris-1, Sorbonne, France

## **Appendix:**

### **Mandate for the evaluation of Simula Research Laboratory**

The objective of this evaluation is to give the Research Council of Norway an impartial and complete report on the activity at the Simula Research Laboratory (Simula). The evaluation will be used to determine the future financing of the centre.

The evaluation shall include:

1. An overall evaluation of the centre including administrative and leadership aspects.
2. An evaluation of each of the departments and their scientific production.
3. An evaluation of the scientific plans for future research at the centre.

The basis for the evaluation will be:

- The original research plan for Simula.
- A self evaluation from Simula including lists of scientific publications and the 5 most important publications from each of the research groups.
- A plan for the scientific activity in Simula for the next 5 years.
- A site visit to Simula.

The Committee is asked to evaluate the scientific results achieved, their importance and their quality including both national and international cooperation. The committee is also asked to evaluate the organisation and leadership of the research groups.

We specifically ask the committee to address the following issues:

#### **Simula Research Laboratory**

1. Does Simula Research Laboratory conduct research at an international level?
2. Does the research at Simula Research Laboratory address fields that are accepted as important internationally?
3. Is there a satisfactory degree of scientific cooperation between the Simula Research Laboratory and international and national research centres?
4. What is the contribution from Simula Research Laboratory regarding education at the MSc and PhD level in informatics?
5. Does Simula Research Laboratory appear to be an attractive research partner for the best researchers in Norway and respected international researchers?
6. Is the research of Simula Research Laboratory relevant for Norwegian industry and society?
7. Has the Simula Research Laboratory worked actively to promote the establishment of businesses based on the research in the lab?
8. Comment on the research plans for the next five years.

#### **Research Departments**

1. Present an assessment of the department's scientific contributions.
2. Is the scientific production reasonably large in view of the available financial resources?
3. Does the department actively cooperate with international research groups?
4. Is the recruitment of scientists to the department satisfactory?

5. Is there a reasonable balance between various categories of employees; PhD students, post docs. researchers and professors?
6. Is the department organised in a reasonable manner?
7. Is the scientific leadership working properly?
8. Comment on the research plans and strategy for the department.

**Simula Innovation as**

1. Does Simula Innovation possess the necessary skills to turn research to business?
2. Does Simula Innovation have the ability to obtain necessary financial resources?
3. Does Simula Innovation have access to people with sufficient market knowledge?
4. Does Simula Innovation have good contact with investors?